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ABSTRACT

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Chicago EARLY Program Follow-Up: A Longitudinal Analysis*

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Abstract

Since 1975, the Chicago public schools have been conducting ongoing research and development related to the identification and remediation of prekindergarten children with potential learning problems. The present study** describes initial efforts toward the creation of a longitudinal data base aimed at determining (1) prekindergarten-age characteristics related to later school achievement, and (2) predictive validity of the Chicago EARLY Assessment. The study reports details of the follow-up of the original EARLY sample and reliability data on the EARLY Assessment. The authors strongly argue the importance of conducting longitudinal research in the public schools.

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INTRODUCTION

Since the fall of 1975, a major thrust in the Department of Research and Evaluation of the Chicago public schools has been to determine the feasibility of identifying children with potential learning problems and remediating those problems before the children reach kindergarten age. Two major activities have evolved from this goal: (1) the development and validation of a test to identify children with potential learning problems (Naron, 1977); and (2) the development of a remedial program for helping children overcome these problems (Naron, et al., 1979). The materials resulting from this R & D effort are the Chicago EARLY* Assessment and the Chicago EARLY Instructional Activities.

During 1976-1978, approximately 1900 preschool children were administered the EARLY Assessment in a series of three studies: Pilot, Validation, and Remediation Screen. The assessment, which consists of five subtests (Gross Motor, Fine Motor, Language, Visual Discrimination, and Memory), is available in both English and Spanish versions. The assessment takes 15-30 minutes to administer and has been found to have excellent concurrent validity when compared with a much longer battery of diagnostic tests (Naron, 1977). It is currently being used in Chicago's ESEA Title I and Head Start prekindergarten programs, where the results are used to place children in an appropriate section of the associated remediation curriculum and/or to refer them for further evaluation (Naron and Perlman, 1981). The specific items on the assessment are listed in Appendix I.

OBJECTIVES

The first objective of the study is to investigate the reliability of the Chicago EARLY Assessment. Since the original sample of children included in the EARLY study have all reached elementary school, sufficient data are available to begin a longitudinal analysis. Therefore, the second objective is aimed at an initial determination of the predictive validity of the EARLY Assessment. The third objective is to explore the characteristics of preschool age children which are associated with school performance and measure of cognitive, perceptual, and social development.

EARLY Reliability Studies

Approximately 160 three- and four-year-olds enrolled in Chicago public school prekindergarten programs were given the EARLY Assessment as part of the reliability studies. These data were used to calculate coefficient alphas for the total test and five subtests. In the interrater study, a child's responses to test items were simultaneously (and without collaboration) rated by either the child's teacher and a Research and Evaluation staff member or by two Research and Evaluation staff members. Test-retest reliability was determined by having the same research team member test a child and then readminister the test after a one-week interval. At issue here were practice effects as well as reliability per se.

*EARLY Assessment and Remediation Laboratory)

Results of the reliability studies are given in Tables 1-3. The EARLY Assessment was found to have very good internal reliability, with a coefficient alpha of .89 for the total test (standardized item alpha = .93) and alphas for the subtests between .56 and .86; these are relatively high given that most of the subtests have only three to five items. The test-retest reliabilities for the five subscales range between .72 and .91; there was no evidence of a practice effect that caused significant improvement on the retest. Interrater reliability was excellent (r = .87 to .98 for the five subtests) and there was no tendency for a teacher who was familiar with a child to systematically rate that child higher or lower than the tester from Research and Evaluation.

TABLE 1

EARLY ASSESSMENT INTERNAL RELIABILITIES

Subtest	Coefficient Alpha	N
Language	.86	149
Gross Motor	.70	151
Fine Motor	.69	152
Visual Discrimination	.56	147
Memory	.61	139
TOTAL TEST	.89	139

TABLE 2

TEST-RETEST RESULTS
(N=57)

	Pretest		Posttest		Reliability Coefficients
Subscale	mean	s.d.	mean	s.d.	
Language	31.9	5.1	32.8	4.4	.91
Gross Motor	12.8	2.7	12.9	2.4	.72
Fine Motor	7.7	2.4	8.1	2.4	.88
Visual Discrimination	9.5	3.0	10.7	2.4	.73
Memory	26.9	6.1	26.9	5.3	.78

TABLE 3

INTERRATER RELIABILITY

	TESTERS		POOLED RESULTS
Subscale	Teacher and R&E staff member (N=26)	both R&E staff members (N=35)	(N=61)
Language	.99	.96	.98
Gross Motor	.77	.92	.87
Fine Motor	.91	.94	.93
Visual Discrimination	.98	.95	.96
Memory	.93	.92	.92

Predictive Validity Study

Of the 1,889 children who were given the EARLY Assessment between 1976 and 1978, 763 had at some time been enrolled as of December 1979. This is a reasonable figure, since many of those initially tested had been enrolled in private preschools. The predictive validity study focuses on the remaining 653 children, who at the time of this follow-up study were between the ages of five and eight and were enrolled in 151 schools throughout Chicago.

EARLY mean subtest scores for students in the follow-up sample were quite similar to those of the entire original population, so there is no evidence of selective attrition of either high- or low-scoring children. Although the total population of 1889 children reflected the racial makeup of the school system (54 percent black, 30 percent white, 11 percent Hispanic, and 5 percent other), the black children are proportionately over-represented and whites are under-represented in the follow-up sample.

The heart of the predictive validity study was an attempt to find relationships between several sets of predictor variables and several sets of criterion variables. The variables studies are listed in Figure 1. The predictor variables were obtained during 1976-1978 when the children were from three to five years of age. The criterion data were collected during the spring of 1980. A more complete description of these variables is included in Appendix III.

The predictor variables include:

- EARLY Assessment item and subtest scores
- Observational data (speech, hearing, vision, attention span, other behaviors)
- Background data from parent questionnaires (e.g., parents' education; occupation; ethnicity; SES; number of siblings; child's birth weight; and characteristics of the mother's pregnancy; information on the child's health and development from infancy thru the testing period).

Among the criterion variables are:

- Diagnosis of learning disability or other condition requiring special education services
- Multiple measures of reading and mathematics performance, including standardized test scores (Comprehensive Tests of Basic Skills, or Iowa Tests of Basic Skills, depending on the child's age), report card grades, and criterion-referenced test results.
- Data from a teacher reporting form (see Appendix II) which measures the extent to which the child exhibits learning, psychomotor, or affective problems that could affect school performance. For comparison purposes, norms on this instrument were obtained on a randomly selected group of approximately 800 five-to eight-year olds who have been identified as needing special education services.

FIGURE I - SCHEMATIC REPRESENTATION
OF THE EARLY FOLLOW-UP STUDY*

PREDICTOR VARIABLES

(data collected during the EARLY pilot, validation, and remediation screen studies, 1976-1978)

EARLY Assessment Data
- standardized and raw item and subtest scores
- weighted and unweighted total test scores.

Tester Observation Variables
- behavior
- articulation
- condition of eyes and ears

S.E.S. Variables
- parents' education
- parents' occupations
- family income

Family Constellation Variables
- number of adults in household
- data on siblings
- mother's age

Child's Health Variables

Language Background

Psychomotor Development

Cognitive and Social Development

Affective Variables

Miscellaneous Variables

CRITERION VARIABLES

(data collected for the follow-up study, 1980)

Achievement Variables
- ITBS scores
- CTBS scores
- reading and math Continuous Progress mastery levels (based locally constructed criterion-referenced tests)
- report card grades
- factor scores from principal components analyses of the above variables.

Learning and Psychomotor Index
- awkwardness
- trouble with reversals
- eye/hand coordination
- memory
- etc.

Affective Variables

Special Education vs. Non-Special Education, Discrimination Index

Recommendation for Special Education Screening

Special Education Classification

Teacher Ratings of School-Related Problems

***See Appendix III and Appendix IV for a more detailed description of the variables.**

Because of the vast amount of data involved, both predictors and criteria were organized into groups of related variables in order to streamline the analysis. Although there were some initial hypotheses, e.g., that the EARLY test would predict later psychomotor problems or placement in special education programs, the study was conducted in an exploratory fashion, with each group of predictor variables being paired with each group of criterion variables (see Figure 1). For the sake of brevity, only those results of particular interest will be included in this paper. A more complete report is available upon request from the Spencer Foundation.

In interpreting the results of this study, several factors should be kept in mind:

(1) The EARLY Assessment was not designed to predict achievement per se, but rather to locate possible problem areas. To say that a child has no particular learning problem does not necessarily imply that he/she will do well in school. Conversely, to find that a child is weak in some area at an early age is not to say that he/she will still be weak three years later: various kinds of formal or informal remediation may have solved the problem in the interim. For example, in the earlier validation and remediation screen studies, parents and teachers were given EARLY Assessment results and recommendations for possible remedial activities. The extent to which this information may have been used is unknown.

(2) With regard to the use of standardized tests as criterion variables, the reader should be aware that in general, children in Chicago public schools are on level at the second grade, but tend to be at least one year behind national norms by the fifth grade. Since the follow-up children are in first and second grade at the time of this study, it would not be expected that the developmental "slump" which affects our students would have reached these students yet. This "slump" which occurs may be partially attributable to a shift in emphasis from decoding skills to comprehension. In any case, the age of the follow-up children at the time of this study is not the most likely age to show up problems related to standardized achievement measures.

(3) Recommendation for placement in a special education program is also not a "clean" criterion variable in this study. For one thing, the EARLY Assessment is designed to identify the child who has normal intelligence but shows large discrepancies in ability among various different skill areas. This type of child is difficult to identify at a young age, because the problem is usually not as obvious or severe as other exceptionalities (Naron, 1981). Therefore, many of these children would not likely be recommended for special education until later in school. Furthermore, teachers are somewhat reluctant to recommend children with mild learning problems for special education at this young an age, because they "may grow out of it." Another factor to be considered is that recommendation for special education encompasses many different kinds of problems, such as emotional disturbance, which are unrelated to the specific objective of the EARLY Assessment.

(4) Since the EARLY Assessment was designed to discriminate more finely at the bottom of the score distribution than at the top, ceiling effects are often present, especially for older children. In interpreting the correlations between predictor and criterion variables, it should be considered that many variables may have relatively little variance, either because of ceiling effects (e.g., EARLY subtest scores) or because of restricted range, as in the case of the many dichotomous variables. It is possible that correlations may be low simply because of the small amounts of variation which are possible.

The EARLY Assessment predictor variable was analyzed in two different ways for examining its relationship to the criterion variables of later academic achievement, learning and psychomotor problems, and recommendation for special education evaluation. In the first method of analysis, regressions of the unstandardized EARLY total and subscale scores were done on the criterion variables, with the follow-up sample both studied as a whole and broken into groups according to the age at time of testing. In the second method of analysis, performance on the EARLY Assessment was defined according to specific cut-off points which may be used for education decision-making.

As well as looking at the follow-up sample as a whole group, the researchers conducted analyses according to the age at which the child took the assessment. This was done to determine whether there is an optimal age range for administering the EARLY Assessment to obtain results most predictive of later school difficulties. For these analysis, the sample was divided into four age groups:

(1) children tested between 30 and 41 months of age (N=33)
(2) children tested between 42 and 47 months of age (N=132)
(3) children tested between 48 and 53 months of age (N=186)
(4) children tested bwtween 54 and 66 months of age (N=126)

In the study of the relation of EARLY scores with later measures of academic achievement, three academic achievement measures were used: report card grades; standardized achievement tests; and continuous progress reading and math levels based on locally developed criterion-referenced tests. The Comprehensive Tests of Basic Skills (CTBS) was administered to most children below seven years of age and the Iowa Tests of Basic Skills (ITBS) was given to children seven years of age and older and to some six-year olds. A principal components factor analysis was used to weight the contributions of report card grades, standardized tests and continuous progress levels for the ITBS and CTBS groups. For children who took the ITBS, the factor analysis yielded two factors: CA1, a measure of ITBS scores and teacher grades and CA2, a measure of continuous progress reading and math levels. Similarly, for children who took the CTBS the factor analysis yielded CA5, a measure of CTBS scores and teacher grades and CA6, a measure of continuous progress levels.

The results of the regressions of the EARLY Assessment with a linear combination of CA1 and CA2 or CA5 and CA6 for children tested on EARLY from 42 to 47 months of age and from 48 to 53 months of age are presented in Table 4.

TABLE 4

Regressions of EARLY with Academic Achievement Variables for Different Ages

	ITBS 42-47 months (CA1, CA2)			CTBS 42-47 months (CA5, CA6)		
	R	df	F	R	df	F
GRSMTR	.32	2,83	4.72*	.41	2,37	3.66**
FINEMTR	.35	2,83	5.600**	.39	2,37	3.58*
VISDISC	.30	2,83	4.18*	.43	2,37	4.43*
LANG	.43	2,83	9.64**	.40	2,37	3.71*
MEMORY	.16	2,83	1.04	.29	2,37	1.78
TOTAL	.32	2,83	4.66**	.39	2,37	3.57*
TOTALWT	.34	2,83	5.44**	.40	2,37	3.78*
	48-53 months (CA1, CA2)			48-53 months (CA5, CA6)		
GRSMTR	.04	2,108	.10	.21	2,73	1.70
FINEMTR	.07	2,108	.30	.09	2,73	.29
VISDISC	.12	2,108	.85	.07	2,73	.16
LANG	.02	2,108	.85	.20	2,73	1.49
MEMORY	.06	2,108	.19	.27	2,73	2.85
TOTAL	.01	2,108	.01	.16	2,73	.91
TOTALWT	.02	2,108	.03	.13	2,73	.59

*sig.= .05
**sig.= .01
***sig.= .001

The pattern of results for the ITBS measures of academic achievement match those obtained for the CTBS measures, thereby providing some validation of the results. All of the subscales except Memory predict academic achievement on the ITBS and CTBS measures for children who took the EARLY Assessment between 42 and 47 months of age. The values for the multiple R (TOTALWT with ITBS = .34; TOTALWT with CTBS = .40) indicate some scatter in the scores even over the limited age range of 42 to 47 months for both measures. The percentage of variance in academic achievement explained by the weighted totals on the EARLY Assessment is 10% for the ITBS group and 16% for the CTBS group. No significant relationships at the .05 level were found between the EARLY Assessment and academic achievement on the ITBS or CTBS measures for children taking the EARLY Assessment in the other age ranges. (Please note that there were insufficient data at the lowest age range to make any conclusions.)

The variables from the teacher questionnaire dealing with awkwardness, difficulty copying, coordination, memory, problems with reversals, ability to follow directions, and self-expression were combined to form the variable LRNPSYMTR. A copy of this teacher questionnnaire is in Appendix II. The regressions of the EARLY Assessment with the variable LRNPSYMTR for children who took EARLY between 42 and 47 months of age and those who took it between 48 and 53 months of age are summarized in Table 5.

TABLE 5

Regression of EARLY with LRNPSYMTR for Different Age Groups

	42 to 47 months			48 to 53 months		
	R	df	F	R	df	F
GRSMTR	.11	1,130	1.55	.18	1,184	6.67*
FINEMTR	.18	1,131	4.22*	.21	1,186	8.42**
VISDISC	.17	1 130	3.90*	.28	1,186	15,98***
LANG	.19	1,130	4.75*	.30	1,186	18.85***
MEMORY	.11	1,131	1.54	.31	1,185	19.25***
TOTAL	.14	1,133	2.53	.33	1,187	22.34***
TOTALWT	.14	1,133	2.82	.31	1,187	19.61***

*sig.=.05

**sig.=.01

***sig.=.001

For children tested between 42 and 47 months of age, the EARLY Fine Motor, Visual Discrimination, and Language subtests are significantly related to the variable LRNPSYMTR. For children tested between 48 and 54 months of age, all the EARLY subscales and the total score were significantly related to the variable LRNPSYMTR. This variable accounted for 11 percent of the variance (R^2= .11) of the total EARLY score.

As well as being sent to the teachers of the children in the EARLY follow-up sample, the teacher questionnaire was also sent to teachers of a randomly selected comparison group of special education children. A discriminant function analysis was performed to find the linear combination of teacher questionnaire variables which best discriminated between the special education group and the EARLY follow-up group (excluding those children in the follow-up sample who were recommended for possible placement in special education classes). The function thus obtained is the criterion variable INDEX. The results of the regression analysis using the EARLY scores with the variable INDEX for the children in the follow-up group who took the EARLY Assessment between 42 and 47 months of age and between 48 and 54 months of age are given in Table 6.

TABLE 6

Regression of EARLY Assessment with INDEX for Different Age Groups

	42 to 47 months			48 to 53 months		
	R	df	F	R	df	F
GRSMTR	.08	1,130	.84	.12	1,184	2.74
FINEMTR	.11	1,130	1.73	.10	1,184	2.13
VISDISC	.13	1,130	2.19	.18	1,186	6.39*
LANG	.23	1,130	7.05**	.21	1,186	8.89**
MEMORY	.13	1,130	2.20	.21	1,186	8.88**
TOTAL	.11	1,130	1.75	.20	1,187	7.41**
TOTALWT	.11	1,130	1.53	.17	1,187	5.80*

*sig.=.05

**sig.=.01

***sig.=.001

The regression results for children tested in the age group of 48 to 53 months of age were significant at the .05 level or better for the total EARLY test scores and on the Visual Discrimination, Language and Memory subscales. Total scores on the EARLY Assessment account for less than four percent of the variance in INDEX.

The regression analysis of the EARLY Assessment scores with the variable of having been recommended for special education evaluation (BLUESLIP) indicates no relationship between the EARLY test scores and actual placement of children in special education. Several factors may have influenced these results:

(1) Relatively few children in the follow-up EARLY sample have been "blueslipped" at this time (N < 40); of these, fewer than ten had actually been placed in special education classes.

(2) A child is "blueslipped" for reasons that are not necesarily related to the type of problem targeted by EARLY (e.g., emotional disturbance).

(3) The children in the follow-up study may not yet be old enough for some types of problems to have appeared.

(4) Teachers may hesitate to "blueslip" primary grade children;

To sum up, the results of the regression analysis indicate certain relationships between the EARLY Assessment and later performance in school. These relationships seem to vary by age at which the assessment is given and by criterion variable. Specifically, for the children tested at age 42 to 47 months, the EARLY Assessment was significantly related to school achievement three to five years later, as measured by standardized achievement tests. For the children tested at age 48 to 53 months, the EARLY Assessment was significantly related to learning and psychmotor difficulties in the classroom, as measured by a follow-up teacher questionnaire, and also to specific characteristics of special education children.

More extensive analyses will be conducted to determine if there is anything unusual or special about the two groups of children tested at the two older age levels (i.e., the groups for which significant relationships were found). There were proportionately more children tested (43.9%) at the age of 43-48 months in the first administration of the EARLY Assessment (the Pilot Study) than in the later two administrations (with 7.6% and 23.3% of those samples having been tested at that age level). Therefore, it may be that there is a longer duration of time between when EARLY was taken and the time of the current study for this group than for the others. If no such patterns are found for this group other than the time at which the took the assessment, than it would appear likely that there may be an optimal age at which to administer the EARLY Assessment for predictive abilit .

Stepwise regressions were used to indicate which EARLY subscales contributed to the variance for the measures of academic achievement (CA1, CA2, CA5, CA6, test scores or continuous progress levels) and for the LRNPSYMTR and INDEX variables. The results of the stepwise regressions of EARLY subscales with these academic achievement variables for children tested at different age levels are summarized in Table 7. The EARLY subscales which predicted each criterion variable are also listed.

TABLE 7

Regressions of EARLY with Achievement, LRNPSYMTR, and INDEX

Age at EARLY Testing	Academic Achievement*		LRNPSYMTR	INDEX
	ITBS group	CTBS group		
42-47 months	Language	Vis. Disc.	Language	Language
	Academic Achievement		LRNPSYMTR**	INDEX**
	ITBS group	CTBS group		
48-53 months	None Significant	Vis. Disc.	Memory	Memory
		Memory	Vis. Disc.	Vis. Disc.

*Regression of EARLY test with academic achievement significant at the .05 level for children tested at 42 to 47 months of age.

**Regression of EARLY test with LRNPSYMTR and INDEX significant at the .05 level for children tested at 48 to 53 months of age.

In interpreting these results for the different ages at which the children were tested, one sees that the Language subscale is related to academic achievement, LRNPSYMTR, and INDEX for children tested at 42 to 47 months of age. The Memory scale is related to academic achievement, LRNPSYMTR, and INDEX for children tested at 48 to 53 months of age. Results from the stepwise analysis and an examination of the items included in the Language and Memory subtests provided evidence that the children "top out" in some subtests at younger ages than on other subtests. As a result, different subscales tend to discriminate better at some age levels than at others. Thus, while the Language items appear useful in predicting learning difficulties for children tested at 42 to 47 months of age, they do not discriminate well among the children tested at 48 to 53 months old. For children tested when they were 48 to 53 months old, the more difficult Memory items become a more important factor in predicting learning difficulties.

Differences in the subscales which predict academic achievement for the ITBS group and the CTBS group are likely to be a result of different cognitive emphases in the two tests and corresponding curricula. Children in the (older) ITBS group are actively involved in developing their reading skills. Language and memory are important factors in this program, and therefore academic achievement would likely be related to subscales meauring these skills. The CTBS, however, is more visually oriented, and children who take the CTBS are likely to be in reading readiness programs which emphasize visual discrimination skills; therefore, scores on the EARLY Visual Discrimination subscale are likely to be related to later academic progress measured by the CTBS.

To sum up, the EARLY Language subscale is important in predicting academic achievement three to five years later for children tested at 42 to 47 months of age. This may be true because the Language subscale is at an appropriate level of difficulty to discriminate among the children in this age group, relates to the curriculum in which the child is involved; reflects the orientation of the ITBS test, and accounts for the largest amount of the variance in academic achievement measures. Similarly, the EARLY test significantly predicts academic achievement on CTBS measures (for children tested with EARLY at 42 to 47 months of age), probably because the Visual Discrimination subscale is related to the children's curriculum, reflects the visual orientation of the CTBS, and accounts for the largest portion of the variance in CTBS measures.

The EARLY Assessment (particularly the Memory subscale) significantly predicts LRNPSYMTR and INDEX for children tested between 48 and 53 months of age. This may be because the items in the Memory subscale are especially sensitive measures of the development of children at this age, and the subscale does account for the largest amount of variance in LRNPSYMTR. The EARLY Assessment does not significantly predict LRNPSYMTR or INDEX for children tested at 42 to 47 months of age. The Language subscale accounts for more of the variance in the EARLY Assessment but is not as useful a predictor of LRNPSYMTR or INDEX as the Memory subscale is for the older children.

Predictive Validity When Using Cut-Off Scores

The EARLY Assessment is currently used by Chicago prekindergarten teachers to make various educational decisions according to different percentile rank cut-off points. Specifically, the teachers are alerted to provide remediation for students who score in the lowest 30 percent on any given subscale, and to do various follow-up procedures when the student scores in the lowest 10 or 20 percent on combinations of Language, Memory, and Visual Discrimination, and on combinations of Gross Motor, Fine Motor, and Visual Discrimination. Therefore, the second method of analysis used to determine relationships between the EARLY Assessment and later school learning problems involved using EARLY cut-off points instead of EARLY subscale and total scores as the means of classifying the students.

In all, 18 different cut-off points were examined, in an attempt to ascertain the optimal cut-off points for predicting later school learning difficulties. The specific cut-off points which were examined are: scoring in the lowest 10 percent on any one subscale or on any two subscales, scoring in the lowest 30 percent on any one subscale, and scoring in the lowest 10, 20 or 30 percent on the following combinations of subscales--both Language and Memory; any two or all three of Language, Memory, and Visual Discrimination; any two or all three of Gross Motor, Fine Motor, and Visual Discrimination. The children in the follow-up sample were identified as being above or below each of these cut-off points. Matrices were constructed to determine how well the different EARLY cut-off scores predicted the children who were later identified as having learning and psychomotor difficulties in the classroom, as measured by the follow-up teacher questionnaire. The EARLY cut-off points were also compared to the variable of having been considered for special education evaluation three to five years later.

The four cells of each matrix indicated:

(1) the number of children identified by both the EARLY cut-off score and by the later school measure as not having problems,

(2) the number of children identified by EARLY as not likely to have problems but who do have some according to the later measure,

(3) the number of children identified by EARLY as likely to have problems but who do not according to the later measure, and

(4) the number of children identified by both the EARLY cut-off score and by the later measure as having some learning problems.

Optimally, the second cell size is the one to be minimized (to avoid missing preschool age children who in fact have later learning problems) and the first and fourth cell sizes are to be maximized for most accurate identification. Such matrices were developed for each of the 18 different EARLY cut-off points and the later measures of psychomotor and learning difficulties and special education recommendation. Each matrix was examined for finding the maximum "hit" rate and minimum "miss" rate, and chi squares were computed to determine the significance of the relationships.

To summarize the results of this analysis, none of the EARLY cut-off scores was related to recommendation for special education evaluation three to five years later. However, 13 of the 18 EARLY cut-off scores were significantly related to later psychomotor and learning difficulties in the classroom, as measured by the follow-up teacher questionnaire. The five EARLY cut-off points which were not significantly related all identified either less than five percent or more than 60 percent of the sample as below the cut-off point. Therefore, these would be useless cut-off points in any regard.

Of the 13 cut-off points found to be significantly related to later learning difficulties, seven were chosen as optimal in identifying a reasonable number of children below the cut-off point (from 7.8 to 27 percent of the chidren identified). The cut-offs based on combinations of the Language and Memory subscales were significantly related to the "memory" item on the follow-up teacher questionnaire, while the optimal cut-off based on the combination of the motor subscales was significantly related to the "copying," "coordination," and "reversal" items on the teacher questionnaire. These results provided evidence of the validity of the diagnostic qualities of the EARLY Assessment.

On the average, the optimal EARLY cut-off points agreed with the follow-up teachers' evaluations in about 80 percent of the cases, and disagreed in about 20 percent of the cases. This is a relatively high "hit" rate when considered over a three- to five-year period. Further analyses are being conducted to see what characteristics may be peculiar to the two groups of children whose classification is not agreed upon by the two measures.

Other Predictor Variables

An important additional source of information on children's psychomotor, social, and physical development came from questionnaire data collected from parents at the time their children were given the EARLY Assessment. Parents described their own education, family size, income, and health problems as well as characteristics of their child such as birth weight, health, television-watching habits, and behavior.

The questionnaire was submitted by partents of more than half of all the children in the follow-up study. Most forms were completed by the child's mother. In more than 40 percent of the cases, the child came from a one-parent home, and half the children had working mothers.

The information from the EARLY parent questionnaire was compared to reports from classroom teachers gathered in the follow-up study. Regression analyses identified the mother's level of education as the strongest socioeconomic variable related to the likelihood of the child's being recommended for special education evaluation. Birth weight, sex (boys seem to be more prone to having school problems) and the parents' seldom-given response that the child might have difficulty in learning accounted for a small but significant portion of the variance in the teacher questionnaire results.

Though the parent questionnaire data when taken alone may have only limited use in prediction, information on a child's family background and development can provide important supplementary information on the child's special needs. Furthermore, the fact that the variables found to be related to later achievement are those which are traditionally found to be related to achievement lends validity to the other results of this study.

The Importance of Longitudinal Research

Although the conducting of longitudinal research has been strongly advocated (e.g., Gallagher et al., 1976), relatively few such studies have been carried out, particularly with children as young as those in the present study. The paucity of such research is largely attributable to the amont of time and expense involved. Especially for academic researchers, there is very little reward for doing such in-depth research when one must wait several years to collect the important part of the date.

On the other hand, the public school system is an ideal place to conduct such research. It is particularly in the interest of the public schools to determine early characteristics related to later school learning problems, in order to devise appropriate intervention strategies to avoid such problems. Furthermore, in systems such as Chicago where there is an established ongoing data base of all the children enrolled, it is not that difficult to systematically follow the children through school, once initial efforts have commenced.

In the present study, a continuation of longitudinal research in the future can provide information on the effectiveness of the EARLY remediation component. The sample of children included in this follow-up study did not formally receive explicit intervention aimed at their weak areas. Therefore, the relationships found between early characteristics and later learning are relatively "free" of any specific systematic treatment. The children who are in the Chicago public schools' prekindergarten programs now, however, are

regularly given the EARLY Assessment, and the teachers have explicit information on how to provide instruction aimed at the children's skill weaknesses. Thus, a follow-up in three to five years of children who are prekindergarteners now will yield information on the effectiveness of the EARLY intervention: the relationships found in the present follow-up study should not be found in the later follow-up study if the intervention is effective. In this way, some indication of the effectiveness of the instruction treatment can be obtained without conducting a traditional experimental study requiring the withholding of treatment for a control group and the ethical political and social problems that such procedures can entail (Cohen 1970; Riecken, et al., 1974, Ch. 8).

Conclusions

Preliminary analyses indicate some definite relationships between the EARLY Assessment and school learning problems three to five years later. The relationships vary by the age of the child at time of testing and the specific measures of later performance. The variable of learning and psychomotor difficulties in the classroom, as measured by a follow-up teacher questionnaire, appears to be most consistently related to the results of the EARLY Assessment. This is the criterion variable which is closest to mesuring what the EARLY Assessment purports to measure. Therefore, the EARLY Assessment definitely has some validity in predicting later school learning problems.

Because many learning problems do not show up until much later than the second grade, this study should be viewed as just the initial effort in a much longer longitudinal analysis. these preliminary findings indicate definite trends in the prediction of later problems, and therefore strongly speak for a continued follow-up of the children in the study for as long as possible.

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Appendix I

List of EARLY Assessment Items by Subscale

Gross Motor

Walking on tiptoe
Walking on a line
Hopping
Throwing and catching a bean bag

Fine Motor

Copying a circle and a cross
Drawing a line between parallel lines
Building a "bridge" with blocks

Language

Giving one, two, and three blocks
Following a two-step direction
Showing "under" and "on"
Showing "big"
Pointing to familiar objects when they are named
Pointing to action in pictures when named
Pointing to familiar object when function is named
Labeling familiar objects

Visual Discrimination

Matching symbols
Assembling two-, three-, and four-piece puzzles
Sorting blocks by shape

Memory

Identifying colors by name
Counting by rote
Recalling two, three, and four unrelated words
Pointing to body parts when they are named
Answering questions ("What do you do when you're sleepy/hungry?")

APPENDIX II

PROJECT EARLY FOLLOW-UP: TEACHER QUESTIONAIRE

Directions: Please answer the following questions by choosing the number on the scale which best represents the behavior of this child. Circle the number you choose. Base your answers on the child's usual behavior throughout the school year compared to the behavior of his or her classmates.

VARIABLE NAME: AWKWARD

1. Does this child appear to be awkward, clumsy, or uncoordinated in moving around the classroom or school, at play, or when performing simple physical tasks?

1	2	3
very awkward, clumsy, or uncoordinated	somewhat awkward, clumsy, or uncoordinated	not awkward, clumsy, or uncoordinated

VARIABLE NAME: QCOPYING

2. Does this child have difficulty copying or tracing letters or designs?

1	2	3
a great deal of difficulty copying or tracing	some difficulty copying or tracing	no difficiculty copying or tracing

VARIABLE NAME: COORD

3. Does this child use pencils, crayons, scissors, glue, building blocks, or other manipulatives in a controlled, coordinated manner?

1	2	3
a great deal of difficulty using manipulatives	some difficulty using manipulatives	no difficulty using manipulatives

VARIABLE NAME: MEMORYTQ

4. Does this child have difficulty memorizing the words of a simple song or poem or reciting numbers in order?

1	2	3
a great deal of difficulty memorizing	some difficulty memorizing	no difficulty memorizing

VARIABLE NAME: REVERSAL

5. Does this child read or write numbers, letters, or words backwards? Does he or she have difficulty differentiating between such numbers as 6 or 9, or the letters b, d, and p?

1	2	3
unable to differentiate; consistent problem with reversals	some difficulty with reversals and differentiation	no difficulty differentiating; doesn't reverse

VARIABLE NAME: INTERACT

6. Does this child interact positively with other children or does he or she often get into fights or seem to be left out of the group?

1	2	3
rarely able to interact positively	sometimes has difficulty interacting positively	no difficulty interacting positively

VARIABLE NAME: UNUSBHVR

7. Does this child exhibit any unusual behavior, such as being withdrawn and unresponsive? ___Yes ___No If yes, please explain or give example.

VARIABLE NAME: FOLDIREC

8. Is this child able to follow simple verbal directions appropriately and comprehend what is said to him or her? (If you circle 1 or 2, please give an example.)

1	2	3
a great deal of difficulty in comprehension	some difficulty in comprehensic	no difficulty in comprehension

VARIABLE NAME: EXPRESS

9. Does this child have difficulty expressing him/herself? Can he or she tell a story or describe an event in a manner comprehensible to the listener?

1	2	3
unable to communicate effectively	some difficulty communicating	no difficulty communicating

If you circled 1 or 2, please give an example.

VARIABLE NAME: POSATTID

10. Does this child generally exhibit a positive attitude towards him/herself and his or her experience in school? (If you circle 1 or 2, please give an example.)

1	2	3
generally negative attitude	sometimes negative, sometimes positive attitude	generally positive attitude

VARIABLE NAME: PROBLEMS

11. Do you believe that this child may have problems which affect his or her ability to perform adequately in school? ___Yes ___No (If yes, please explain. Use additional paper if necessary.)

12. Please give this child's: Age___ Sex ___M ___F

13. Is this child bilingual or from a non-English-speaking background? ___Yes ___No

VARIABLE NAME: BLUESLIP

14. Has this child ever been recommended for special education evaluation ("blue-slipped")? ___Yes ___No (If yes, what was the result? Please give the special education classification, if applicable.)

15. Child's average arithmetic grade as of the end of the third marking period (circle one).

E G F U Other (specify)

16. Child's average reading grade as of the end of the third marking period (circle one).

E G F U Other (specify)

17. Child's current continuous progress reading level _____ Math level_____

18. How long has this child been in your class? date entered: __ /__
mo. yr.

Use this space for any comments.

Appendix III

Description of the Predictor Variables

Predictor Group 1: Standardized EARLY Subtest Scores

This set of variables is derived from the original EARLY item scores. So that data could be aggregated across ages, each item score was standardized using the mean and standard deviation of the age group (3 yrs. to 3 yrs. 6 mo.; 3 yrs. 7 mo. to 3 yrs. 11 mos.; 4 yrs. to 4 yrs. 6 mo.; 4 yrs. 7 mo. to 5 yrs.) corresponding to the child's age when he/she took the test. Subtest scores (ZFINEMTR, ZLANGUAGE, ZVISDISC, ZMEMORY) were calculated by adding the appropriate standardized item scores. A total score was then computed by adding all of the individual item scores. Except for the gross motor scale (see Predictor Group 2), a second weighted total was obtained by taking a weighted sum of the subtest scores. The weights were adjusted to take into account the total number of items on each subscale.

ZTOTALWT = ZGRSMTR/15 + ZFINEMTR/10 + ZLANGUAGE/36 + ZVISDISC/13 + ZMEMORY/33

These scores are available for children who were tested when they were between 36 and 60 months old, since norms are available only in that age range. In the instances where scores were analyzed within age group, raw scores rather than standardized ones were used. The Group 1 variables include:

Untransformed Variable	Standardized Variable	Description
GRSMTR	ZGRSMTR	gross motor subscale score
FINEMTR	ZFINEMTR	fine motor subscale score
VISDISC	ZVISDISC	visual discrimination subscale score
LANGUAGE	ZLANGUAGE	language subscale score
MEMORY	ZMEMORY	memory subscale score
TOTAL	ZTOTAL	sum of subscale scores
TOTALWT	ZTOTALWT	weighted sum of subscale scores (see narrative above)

Predictor Group 2: Standardized EARLY Item Scores

These are the individual item scores used to obtain the subtest scores in Group 1 and are available only for children who were tested when they were between 36 and 60 months old. These variables are standardized within age group and include the following:

ZGRSMTR*	gross motor subscale score
ZCOPYING	copying designs
ZPARALLEL	parallel lines
ZBLOCKBRG	blocks/bridge
ZCOLORS	colors
ZNUMCNCPT	number concepts
ZCOUNTING	counting
ZDIRECTNS	directions
ZPREPOSIT	prepositions
ZMATCHSYM	matching symbols
ZPUZZLES	puzzles

*Note: Individual item scores on the gross motor subscale were not available for all students; instead the subtest total was used as a predictor.

ZRECALLWD	recall words
ZSRTSHAPE	sorting shapes
ZBIGLTL	big
ZACTIONPX	action in pictures
ZFUNCOBJ	function of objects
ZBODYPARD	body parts
ZEXPRSVOC	expressive vocabulary
ZCMPREHEN	comprehension

Predictor Group 3: Tester Observation Variables

After the EARLY test is administered, the tester is requested to rate the child on a number of variables including articulation, presence of problem behaviors and the condition of the child's eyes and ears. The variable ARTIC (articulation) is rated on a three-point scale where 0 = difficult to understand all speech, 1 = some single words understandable and 2 = speech easily understood. Behavior (BEHAVIOR) is a dichotomous variable which equals one if the rater observed any of the following types of behaviors: distracted; shy or tense; not attentive; repetition of responses; impulsiveness; refusal to take test; other problems. If none of these is observed, then BEHAVIOR equals zero. This variable is not available for students from remediation screen study, although two other variables, EYES and EARS, are available only for students from that group. The variable EYES can take on values from 0-4 depending on how many of the following were checked off by the tester: eyes squint or strain; eyes turn in or out; eyes red, irritated; child rubs eyes often. The variable, EARS, can take on values from 0-3 depending on which of these were noted: child says "huh" often; discharge or crustiness around ears; any symptoms of congestion.

Predictor Group 4: S.E.S. Variables

These variables were obtained from parent questionnaires at the time of testing; consequently, data are not available for children whose parents did not fill out a questionnaire. The variables in this group include:

OCCUPDAD	father's occupation (1 = white collar 2 = blue collar 3 = not employed)
EDUCMOM	mother's educational level (number of years of school completed)
EDUCDAD	father's educational level
INCOME	family income (1 = less than $6000 per year, 2 = $6,000-$12,000, 3 = more than $12,000). Available only for parents of children in the first two studies.

Because these variables are highly intercorrelated, they could not be used together as a group of predictors in a regression equation without causing problems with multicollinearity. The socioeconomic status (S.E.S.) variables were factor analyzed for Studies 1 and 2 (pilot and validation) taken together and for Study 3 (remediation screen). The analyses each yielded one factor. Indices of socioeconomic status, P41 (Studies 1 and 2) and P42 (Study 3) were constructed by multiplying factor scores by the standardized values of the variables and adding together the results:

P41 = .32 ZEDUCMON - .27 ZOCCUPDAD + .32 ZEDUCDAD + .31 ZINCOME

P42 = .39 EDUCMOM - .36 OCCUPDAD + .40 EDUCDAD

S.E.S. was also operationalized by simply taking family income (when available) and mother's education as proxies for the other variables in this set.

Predictor Group 5: Family Constellation Variables

These variables include the following: NUMADULT, the number of adults in the household; SIBPROPS, a dichotomous index of whether or not the child has siblings who have had problems in school; RECIPKIDS, the reciprocal of the number of children in the household; and AGEMOM, the mother's age. These variables are available only for children whose parents filled out a parent questionnaire.

Predictor Group 6: Child's Health Variables

These variables, too, are only available for children whose parents filled out a parent questionaire. These dichotomous variables indicating problems include the following: PREGPROB (whether the child's mother had any health problems during pregnancy); BIRTHWT, birth weight (under six pounds or at least six pounds); LOBLDSGR, low blood sugar; VISION; HEARING; SPEECH; STOMACHE, stomache aches; TIRED, child is frequently tired; OTHRHLTH, other health problems. In addition, four variables were created through a principal components factor:

P61= -.02 ZPREGPROB + .07 ZBIRTHWT + .11 ZLOBLDSGR + .04 ZVISION + .59 ZHEARING + .60 ZSPEECH-.07 ZOTHRHLTH +.12 ZSTOMACHE -.01 ZTIRED

P62= .63 ZPREGPROB -.54 ZBIRTHWT + .33 ZLOBLDSGR + .11 ZVISION -.09 ZHEARING + .01 ZSPEECH -.02 ZOTHRHLTH + .02 ZSTOMACHE -.04 ZTIRED

P63= .04 ZPREGPROB -.03 ZBIRTHWT -.32 ZLOBLOSGR -.09 ZVISION -.00 ZHEARIN + .02 ZSPEECH + .60 ZOTHRHLTH + .60 Z STOMACH -.11 ZTIRED

P64= .64 ZPREGPROB -.09 ZBIRTHWT + .57 ZLOBLDSGR + .35 ZVISION -.18 ZHEARING + .13 ZSPEECH -.03 ZOTHRHLTH + .07 ZSTOMACHE -.56 ZTIRED

These factors may be interpreted as follows: P61 speech and hearing; P62 pregnancy problems and birth weight; P63 stomachache and other health problems; P64, low blood sugar, fatigue.

Predictor Group 7: Language Background

This group includes three dichtomous variables: HOMELANG (whether the child's first language is English); SPKENG (whether the child speaks English); and UNDENG (whether the child understands English). These data are available only for children whose parents filled out a parent questionnaire.

Predictor Group 8: Psychomotor Development

The variables in this group came from the parent questionnaire which was administered only during the pilot and validation studies. These variables describe the child's behavior and include: TRIPFALL (whether the child often trips or falls); THROWETC (throws, catches, kicks); OPENDRS (opens doors); DROPSPIL (drops or spills food); PLAYWBLK (plays with blocks); CUTWSCIS (cuts with scissors); PLAYWPZL (plays with puzzles); BUTTONS (buttons coat); WASHANDS (washes hands); AGEINMOS (age in months). A principal component factor analysis yielded three factors:

P81 = .22 ZTRIPFALL - .19 ZTHROWETC + .27 ZOPENDRS - .05 ZDROPSPIL - .12 PLAYWBLK + .43 ZCUTWSCIS + .03 ZPLAYWPZL - .33 ZBUTTONS + .41 ZWASHANDS

P82 = .58 ZTRIPFALL - .27 ZTHROWETC + .18 ZOPENDRS - .49 ZDROPSPIL - .16 ZPLAYWBLK + .11 ZCUTWSCIS + .15 ZPLAYWPZL - .00 ZBUTTONS + .05 ZWASHANDS

P83 = .08 ZTRIPFALL - .00 ZTHROWETC - .11 ZOPENDRS - .08 ZDROPSPIL + .59 ZPLAYWBLK + .04 ZCUTWSCIS + .68 ZPLAYWPZL - .01 ZBUTTONS - .07 ZWASHANDS

P81 corresponds to eye-hand coordination, P82 reflects awkwardness, and P83 involves use of blocks and puzzles.

Predictor Group 9: Cognitive/Social Development Variables

These variables come from the questionnaire that was distributed to parents of children in the pilot and remediation screen studies. The variables in this group are RMBRPLCS (whether the child remembers places he or she has been to); KNOWCLRS (knows colors); HELPS (helps with household chores); BIGNLTL

(can distinguish between big and little); REPTIN (whether it is necessary to repeat instructions to child); LRNDIFF (whether the child has difficulty learning); TVTIME (average daily amount of time spent watching television: less than 3 hours, 3-6 hours, 6-8 hours, more than 8 hours); HRDUNDRS (child hard to understand); SHOPPING (child goes shopping with parents); TELLS (child tells stories); EATWKID (parents eat with child); MUSTRPT (whether it is necessary to repeat instructions to the child); ASKSQUES (child asks questions); AGEINMOS (child's age in months).

Predictor Group 9A: Affective Variables

These variables also come from the parent questionnaire. For children in the pilot and validation studies, the variables, all of which are dichotomous, include: TANTRUMS (child throws tantrums); GIVESUP (child gies up easily); PLAYLONE (child plays alone); ACTOUT (child tends to act out); ATTNSPAN (attention span: less than 5 minutes, 5-15 minutes, 15-30 minutes, 30-60 minutes, or more than one hour). For the children in the remediation screen study, the variables are SHY (child is shy) and CRYALOT (child cries a lot).

Predictor Group 10: Miscellaneous Variables

These variables include the child's sex (SEX), birth weight (BIRTHWT), parent's perception of whether the child has learning difficulties (LRNDIFF), and whether or not the child was a steady viewer of Sesame Street (SESAME).

Appendix IV

Description of the Criterion Variables

Criterion Group A: Achievement Variables

These variables include reading and math report card grades (READGRD, ARITHGRD) if available from the teacher questionnaire; continuous progress reading and math levels*recoded to numerical values (CPREAD, CPMATH) where (A = .8, B = 1.3, C = 1.8, D = 2.3, E = 2.8, F = 3.3, G = 4.8, H = 5.4, J = 5.3, etc.) and MEANCPML, which is the average of the recorded reading and math continuous progress levels. In addition, there are Iowa Tests of Basic Skills results for those students old enough to take that test in May 1980: Chicago standard**

*based on locally developed criterion-referenced tests

**Chicago standard scores are local normal curve equivalents with mean = 250 and standard deviation = 21.06

reading, math total and vocabulary test scores (ITBSSTDR, ITBSSTDM and ITBSSTDV, respectively). A composite index, MEANITBS, the average of the reading and math standard scores, was also constructed. Factor analysis provided indices of achievement which use standardized variables:

CA1 = .30 ZITBSSTDR + .22 ITBSSTOM + .28 ZITBSSTDV + .22 ZARITHGRD + .25 ZREADGRD - .12 ZCPREAD - .12 ZCPMATH

CA2 = .12 ZITBSSTDR - .02 ITBSSTOM - .05ZITBSSTDV - .02 ZARITHGRD - .06 ZREADGRD + .54 ZCPREAD + .54 ZCPMATH

For students with CTBS Level B data from spring of 1980, the following variables are available: reading and math raw scores (CTBSRAWR, CTBSRAWM) and a weighted mean of these variables, MEANCTBS, whose weights are based on the lengths of the two subtests:

CTBSMEAN = .5 (CTBSRAWR/84 + CTBSRAWM/56)

Principal components factor analyses also yielded the following index:

CA5 = .38 ZARITHGR + .35 ZREADGRD - .13 ZCPREAD - .20 ZCPMATH + .34 ZCTBSR + .20 ZCTBSM

CA6 = -.16 ZARITHGR - .12 ZREADGRD + .53 ZCPREAD + .59 ZCPMATH - .10 ZCTBSR + .08 ZCTBSM

CA7 = .33 ZCPREAD + .31 ZCPMATH + .27 ZCTBSRAWR + .3 ZCTBSRAWM

Variables in criterion groups A through F are available only for students whose teachers filled out a teacher questionnaire.

Criterion Group B: Current Learning and Psychomotor Variables

These include the items on the teacher questionnaire that deal with awkwardness (AWKWARD), difficulty with copying (QCOPYING), coordination (COORD), memory (MEMORYTQ), problems with letter reversals (REVERSAL), ability to follow directions (FOLDIREC), and self-expression (EXPRESS). An index of these variables was constructed using standardized scores:

LPNPSYMTR = ZAWKWARD + ZQCOPYING + ZCOORD + ZMEMORYTQ + ZREVERSAL + ZFOLDIREC + ZEXPRESS

Criterion Group C: Affective Variables

These variables include how well the child interacts with other (INTERACT), whether he/she has a positive attitude toward school (POSATTID) and whether the child displays any unusual behavior (UNUSBHVR). The following index was also constructed using standardized scores:

AFFUNUS = ZINTERACT + ZPOSATTID + UNUSBHVR.

Criterion Variable D: Discrimination Index

The teacher questionnaire was administered both to teachers of children in the Project EARLY follow-up sample (all who could be located in the Chicago schools in May 1980) and also to a randomly selected comparison group of approximately 800 children in the same age range who have been identified as needing special education services. A discriminant function analysis was performed to see which linear combination of the teacher questionnaire variables best discriminated between the special education group and the children in the EARLY follow-up group, excluding those who had been recommended for special education screening. The function obtained is the variable INDEX:

```
INDEX=-.02 ZAWKWARD + .23 ZQCOPYING +.03 ZCOORD
      +.22 ZMEMORYTQ + .11 ZREVERSAL+ .09 ZINTERACT
      +.26 ZUNUSBHVR - .06 ZFOLDIREC+ .14 ZEXPRESS
      -.13 ZPOSATTID + .34 ZPROBLEMS
```

Using this index, 81 percent of the children in the sample were correctly classified as being part of the special education or non-special education groups.

Criterion Variable E: Recommendation for Special Education Screening

Originally, one of the criterion variables was to have been classification into a special education program. However, since fewer than ten children have been so designated, it was decided to increase the target group to include those who had been recommended for special education screening ("blueslipped").

Criterion Group F: Individual Teacher Questionnaire Variables

These variables include measures of awkwardness (AWKWARD), difficulty copying (QCOPYING), coordination (COORD), memory (MEMORYTQ), problems with reversals (REVERSAL), interaction with others (INTERACT), unusual behavior (UNUSBHVR) and problems in school (PROBLEMS).

Criterion Group G: Blueslip/Masterfile Special Education Classification

Since teacher questionnaires were not completed for all children in the EARLY follow-up sample, another variable, BLUESPED, was created. This is a dichotomous variable which is set equal to one if either of the following is true: (a) the teacher questionnaire indicates that the child has been "blueslipped" (recommended for special education evaluation); or (b) the Chicago student master file indicates that the child has been classified as needing special education services.